



## Real-Scale Implementation of Decentralized Wastewater Treatment and Reuse Systems

### Key findings

Within the framework of the SMART project different decentralized wastewater treatment technologies were implemented at full scale to demonstrate solutions for sustainable integrated wastewater treatment and reuse.

Seven systems at the household level (15 – 35 population equivalents PE)

Three systems with sewer (100 – 300 PE)

Operation, maintenance and monitoring over five years

SBR, Modified Septic Tanks and treatment wetlands demonstrated as promising technologies

Operation and maintenance (O&M) was identified as the key factor for a reliable treatment.

Jordan is one of the world's most water scarce countries, where groundwater resources are indispensable for potable water supply.

Jordan is striving to set a regional

example of a successful implementation of Integrated Water Resource Management (IWRM) concepts and it is expected that it will be the reference case for IWRM knowledge, methods, and application in the Middle East.

The SMART-Projects have supported the Jordanian government by implementing ten full scale systems for decentralized wastewater treatment and reuse as components of an IWRM in the Wadi Shueib region. The construction of the treatment systems has been supported by the companies: WAKILEH Contracting, ATB WATER GmbH, and HUBER SE.



The installed technologies include: treatment wetlands, sequencing batch reactors (SBR), modified septic tanks (MST) and a membrane bio-reactor (MBR). Seven of the systems were installed at household level (15 – 35 inhabitants); and three systems with sewer (100 – 300 PE) to serve larger populations.

The installed MSTs are fixed bed technologies with active aeration. MST is sized to be a one-tank system that entails anaerobic treatment chambers followed by one aerated section with an air pump providing oxygen for intense mixing and pollutant degradation.

This aerobic chamber is filled with fixed bed media (plastic media), making the system more robust against shock loads. The system is characterized by low O&M and land requirements.



In addition to classic SBR systems, a new generation of load-controlled SBR (Puroo) has been installed at house level. The system works without electric pumps and valves. Since the operation is carried out with compressed air, the energy requirement of the technology is very low (30 kWh per inhabitant per year).

The SBR system was honored in 2014 with the international GreenTech Award.



Ecotechnologies such as aerated horizontal sub-surface flow treatment wetlands have high treatment capacity for organic carbon, nitrogen and pathogens, low O&M requirements and are resilient against variable hydraulic and pollutant loads. One such ecotechnology was installed at the Princess Rahmeh College in the Balqa' Governorate, and now provides wastewater treatment for approximately 1,500 students.



The reuse of treated wastewater for some of the full-scale systems is accomplished by subsurface irrigation systems, or if the treatment system was equipped with an additional disinfection unit, the treated effluent could be directly used for unrestricted surface irrigation.



The objectives of full-scale implementation of decentralized wastewater treatment technologies were to a) demonstrate that pilot technologies installed at the Competence Facility for Decentralized Wastewater Management in Fuheis, Jordan are also suitable for use at full scale, b) demonstrate that private homeowners and communities can benefit from reuse of treated wastewater, c) assess the process of implementing decentralized wastewater treatment and reuse systems in Jordan.

It was demonstrated that several technologies developed at the Competence Facility for Decentralized Wastewater Management in



Fuheis can be successfully implemented at full scale, with treatment performance results similar to those observed at the pilot scale. Under the presumption of regulated O&M activities carried out on a regular basis and a fruitful co-operation with site owners, the implementation of DWWT+R within an IWRM concept offers a promising solution to handle problems of water scarcity and groundwater protection.

Decentralized wastewater treatment technologies have been demonstrated to be an appropriate solution for small settlements in Jordan for which connection to centralized wastewater treatment plants is not a cost-effective option. A critical factor in the success of decentralized wastewater treatment technologies is a well-defined operations and maintenance scheme that is centrally managed (for example, by the local water authority).

## References and further Reading

- Al-Zreiqat, I. et al., 2018. Influence of septic tank attached growth media on total nitrogen removal in a recirculating vertical flow constructed wetland for treatment of domestic wastewater. *Ecological Engineering*, 118, pp.171–178
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SMART policy briefs present relevant scientific results of the SMART I, II and -MOVE projects concerning a transferable approach for Integrated Water Resources Management in the Lower Jordan Valley.

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